

PATENT COOPERATION TREATY

From the:
INTERNATIONAL SEARCHING AUTHORITY

To:

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PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year) **23 FEB 2005**

Applicant's or agent's file reference
512575 KRM

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/NZ2004/000327

International filing date (day/month/year)
21 December 2004

Priority date (day/month/year)
22 December 2003

International Patent Classification (IPC) or both national classification and IPC
Int. Cl. ⁷ H02P 006/18; H02K 29/00

Applicant
FISHER & PAYKEL APPLIANCES LIMITED et al

1. THIS OPINION CONTAINS INDICATIONS RELATING TO THE FOLLOWING ITEMS:

- | | | |
|-------------------------------------|------------------|---|
| <input checked="" type="checkbox"/> | BOX NO. I | BASIS OF THE OPINION |
| <input type="checkbox"/> | Box No. II | Priority |
| <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> | BOX NO. V | REASONED STATEMENT UNDER RULE 43BIS.1(A)(I) WITH REGARD TO NOVELTY, INVENTIVE STEP OR INDUSTRIAL APPLICABILITY; CITATIONS AND EXPLANATIONS SUPPORTING SUCH STATEMENT |
| <input type="checkbox"/> | Box No. VI | Certain documents cited |
| <input type="checkbox"/> | Box No. VII | Certain defects in the international application |
| <input type="checkbox"/> | Box No. VIII | Certain observations on the international application |

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/NZ2004/000327

BOX NO. I BASIS OF THE OPINION

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material
☐ a sequence listing
☐ table(s) related to the sequence listing
 - b. format of material
☐ in written format
☐ in computer readable form
 - c. time of filing/furnishing
☐ contained in the international application as filed.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/NZ2004/000327

**BOX NO. V REASONED STATEMENT UNDER RULE 43BIS.1(A)(I) WITH REGARD TO NOVELTY,
INVENTIVE STEP OR INDUSTRIAL APPLICABILITY; CITATIONS AND EXPLANATIONS
SUPPORTING SUCH STATEMENT**

1. STATEMENT

NOVELTY (N)	CLAIMS 1 – 16	YES
	Claims	NO
INVENTIVE STEP (IS)	CLAIMS 1 – 16	YES
	Claims	NO
INDUSTRIAL APPLICABILITY (IA)	CLAIMS 1 – 16	YES
	Claims	NO

2. CITATIONS AND EXPLANATIONS:

NOVELTY (N), INVENTIVE STEP (IS) & INDUSTRIAL APPLICABILITY (IA)

CLAIMS 1 – 16

The invention defined in the present claims relates generally to electronically controlled (commutated) brushless dc motors for fractional horsepower applications such as in home appliances, eg. Washing machines.

The invention defined in the present claims sets out a method and a controller for electronically commutating a permanent magnet brushless dc motor (21) under closed loop control where the current is commutated (22) through successive combinations of two out of three stator windings to produce a rotating flux. Commutations are determined by each 60° angular position of the rotor by sensing the back EMF (24) induced in only one of the three stator windings whenever that winding has no applied current flowing in it to determine the 0° and 180° positions and extrapolating the 60°, 120°, 240°, and 300° positions by dividing the time interval therebetween by a factor of 3. Please see figure 3.

In the present invention, commutation times are derived by extrapolation. This is done by measuring the time between the previous commutations of a phase A, for example the time between A1 and A2, and effectively dividing that by a factor of 3, in routine 31 by multiplying by 1/3 and 2/3 respectively. These calculations are used to generate commutation triggers (sequences) at $A1 + (A2 - A1)/3$ for phase C ("C1"), $A1 + (A2 - A1) * 2/3$ for phase B ("B1"), etc. in routine 47 which together with A1 and A2 produces a full set of triggers (sequences) for the commutation control pulse generator (29).

The characterising (and common) parts or features of the invention (3 independent claims and their dependent claims) is /are the provision of routine 31 and the digital sensing of the back EMF (BEMF) in only 1 phase out of the 3 phases of the motor.

The International Search Report revealed 5 documents of relevance and representing the general state of the art. 3 documents listed below were considered to be the closest to the present invention:

US 5,672,948

US 6,034,493

US 5,534,763

However, none of these documents disclose on their own or in any obvious combination thereof the precise control scheme as defined in the present set of claims. Consequently, the invention defined in the present claims is novel, possesses an inventive step and is also suitable for industrial application.